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Farmer Friendly Agri-Bot'

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Abstract

This system was mainly devised to overcome the use of weedicides for the removal of weeds in the agricultural land and as well as measure the requirements of the land. Farmers mainly using weedicides to kill the weeds. They not only kill the weeds but also affect the native plants. To overcome this robot was designed and it is controlled using Raspberry-Pi coded in python language. There is a camera called Pi-Cam which is used to check for the weeds using Image processing and it is interfaced to a mobile app via IoT. Once Pi-Cam identifies weed the cutter activated automatically and cuts the entire plant to prevent its regrowth. The entire setup is solar powered and there is no need for any fossil fuel for its operation. This significantly reduces the amount of pollution caused. This bot can be monitored in real-time via a mobile app and helps the farmer to keep track of the happenings in the agricultural land. The future advancement of this setup is to grind the removed plants to turn them into manure for the particular land.

Keywords*--Pi-cam, solar powered, automatic weed control systemImage processing, weed in crop, classical classifier*

I. INTRODUCTION

Agriculture has been the back bone of India and many other countries around the world since ages. During these early days most of the population was dependent on agriculture for their day to day life. Man power is highly involved in agriculture when compared with the other professions, but as the technology develops people are also upgrading themselves to work in some high quality job profiles. Taking population into consideration it is growing in a geometric progression. [6] As the population increases the need for the food also increases. To overcome this population, we implement machine which can do their function by themselves. This reduces the man power and the quality of the product can be checked easily in ashorter period of time. In agriculture ploughing, sowing, weeding, harvesting everything requires man power. For the above mentioned processes we are already havingsome automated machines except for a few, one among them is weeding. [8]

II. RELATED WORK

There are various proposed solutions for the removal of weeds from the furrow of the agricultural land. There are present some bigger machines which are man driven, some need to be pushed in the agricultural land in order to remove the weeds from their land.[1][3] Automated machines are also present but those kinds of devices or machines are slow in their process as they go near the weed and pluck the weeds one by one until everything is removed. Some devices also make use of a robotic hand like structure which identifies the weed in the land and drops the weedicide in the land which might kill the weeds but will also have a direct effect on the native plants. The man driven machines require fossil fuel for their functioning. Use of these fossil fuels will result in the emission of toxic gases into the atmosphere and will have an adverse effect on the planet earth. These processes also involve huge amount of money to be spent in buying and also the man driven machines need to be maintained regularly or else they might not function properly. This in turn increases the amount spent by farmer in the removal of weed from the land. Some of the existing machines that need to be pushed through the agricultural land are larger in size and require man power as shown below. This is efficient in cost but is

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little time consuming.[7]

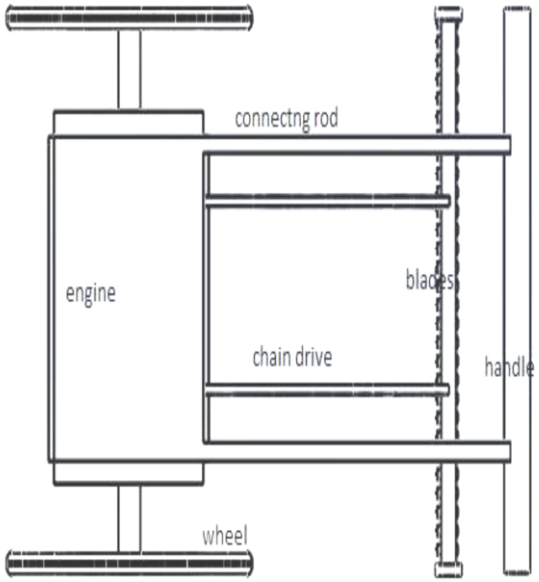

Fig 1. Mechanical method of removal by pushing through the furrow

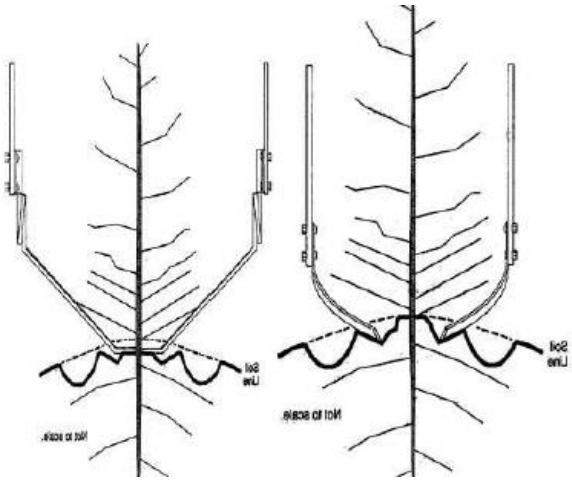

Fig 2. Plucking the weed from the land using a hoe and knife mechanism.

III. NEED FOR WEED REMOVING AGRIBOT

Now a day's we are facing big issues in controlling the weeds in the agriculture field. Mostly weeds are controlled by herbicides, due to herbicides the ground water is contaminated and also spoils soil condition. Another way to control the weeding is hand weeding but it won't be effective for wide range of agriculture land.[2]These plants compete with the native plants for nutrition and other necessary things; it is a great threat to the farmers. The effect of weeds in agricultural land is in greater extent. The amount of loss encountered by the farmer is more due to weeds when compared with the other factors that are involved in the agriculture. To overcome these problems, we proposed robot it helps the farmers encounter the problem of weeds in an easier manner and it is automated. We are using Pi-Cam in robot for two purposes one for guiding the robot another to identify the weeds by image processing technique and intimate the farmers can monitor the process via mobile app.It is also solar powered which in turn reduces the fossil fuel and reduces pollution.

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IV. PROPOSED MODEL

By using image processing technology with robotics, weed detection and control system developed to give more benefits to the agriculture field such as avoidance of herbicides, shortage of labors and save time [4].

The conceptual representation of farmer friendly agribot is shown in fig.3 to remove weed by the following process.[9]

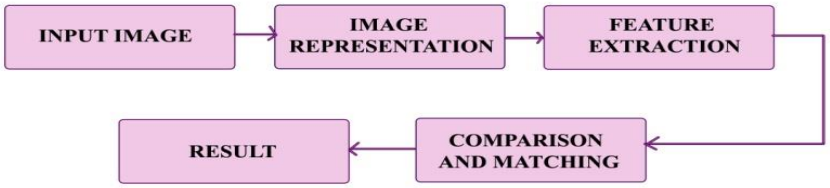

Fig 3. Conceptual representation of farmer friendly agribot

The automatic weed removal system uses specially designed blade for the removal of weeds in the fields with the help of gear motors.

V. BLOCK DIAGRAM

As per the block diagram represented below, raspberry pi is the heart of the entire process. This processes the data what so ever collected with the help of the pi camera along with the other functions provided. Pi camera is a specially designed camera module which can be configured only with raspberry pi. This camera has a 5 mega pixel capacity. The power to the raspberry pi is supplied with the help of solar panel. This energy is stored in the battery for future use as well. Motor driver is used to control the wheels of the robot and the rotating blade which is used to remove the weeds.

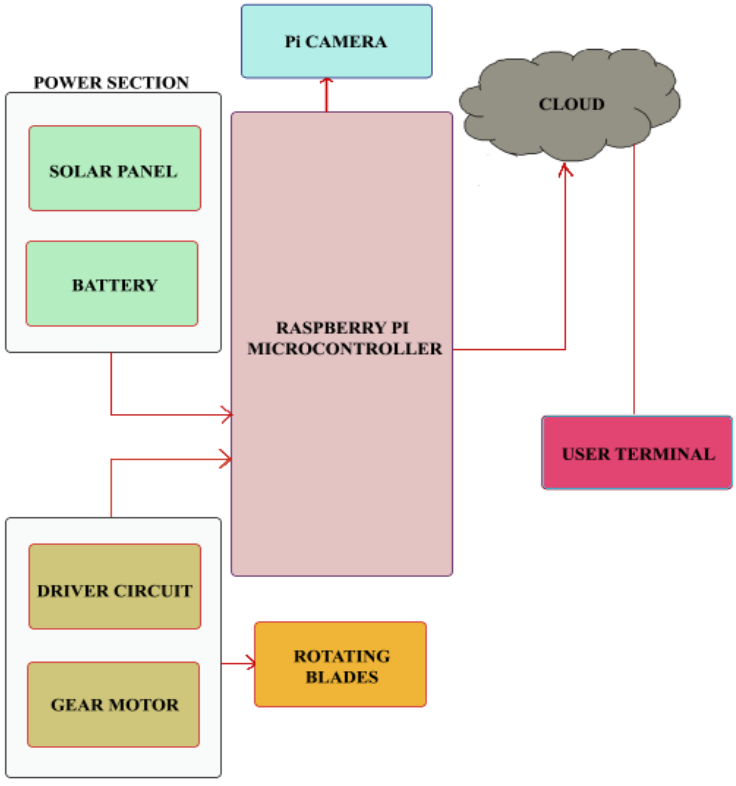

Fig 4. Block diagram representation of farmer friendly agri-bot

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The image captured or scanned with the help of the pi cam is compared with the images that are stored earlier in the cloud database. Cloud is used in order to have a higher capacity of different images of weeds that frequently grow in agricultural land. Also cloud is used to monitor the robot and also control it from any location in case of any mishaps. The images captured if matched with the stored images raspberry pi send commands to turn on the rotating blade to remove the weeds.

TABLE I
MOTOR SPECIFICATIONS

S.No	Specification	Details
1	RPM	200
2	Operating Voltage	12V DC
3	Shaft	6 mm diameter with thread hole
4	Gearbox	37 mm diameter
5	Motor diameter	28.5 mm
6	Weight	180 g
7	Torque	30 kg-cm
8	No-load current	800 mA
9	Load current max	7.5A

TABLE II
BLADE SPECCIFICATIONS

S.No	Design	Details
1	Material	Mild steel
2	Thickness	1mm
3	Dimensions	4cm*3cm

The block diagram of automatic detection and removal of weeds system consist three major systems.

A. Weed Detection Unit
B. Control Processing Unit
C. Results

A. WEED DETECTION UNIT

For weed species identification, image processing can be divided into three general methodologies they are biological morphology, spectral characteristics, and visual texture. [5]

For our proposed system we are using biological morphology technique, it will define the cultivated plants by its shape and structure. The term morphology as applied to image processing with a set of basic mathematical operations using a structuring element. The sample images regarding the shape and structure of the cultivating pants are stored in the cloud database. The agribot placed in the agriculture land captured the plant images and compared with the database present in the cloud. If the captured image is not present in the database that will consider as a weed, then the appropriate action will have taken by control processing unit

B. CONTROL PROCESSING UNIT

The entire system is relying upon the one processor present which is the raspberry pi. This processor receives all the data's or images of the field with the help of a pi camera. This camera is serially interfaced with the help of a 15 pin ribbon cable. This process relies on the data that are previously stored in a cloud database. Cloud is one of the major technologies that have been growing in faster rate in the current generation. As we all know cloud is a platform for easy access and also for high storage capacity. Because of this cloud has become so popular. The cloud storage can be only accessed with the help of internet. To achieve this raspberry pi is provided with an internet for quick comparison and access in

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order to avoid the delay time occurring in the removal of weeds after image capture. The image captured is not in gray scale. If in case in order to avoid external cloud storage, we can also build raspberry's own cloud platform with the help of dietpi which needs to be installed within the raspberry pi with the help of python codes. But usage of external cloud is considered better.[10][11]

C. RESULTS

As mentioned earlier in the detection system that the images captured are compared with the pre stored images in the cloud database. After the images are processed, the raspberry pi sends the command in the form of binary digits to the motor driver. As we all know that the electronic devices present now are mostly digital. Thus if the matching fails the pi sends 0 to the motor driver which will make the motor remain in off state or never turn on. If the output matches the pi will send 1 which is true to the motor diver which either turns on the motor or make it run continuously. Once the signal is positive or '1' the blade starts to rotate. The blade is supported with a gear motor in order to provide the necessary torque and force required to dig through the agricultural land. Once it digs through the land it results in the uprooting of weeds permanently from the land. Thus the major components involved in the process of making the motor run are the pi camera and the cloud database result.[12][13]

VI CONCLUSION

As said earlier agriculture has been the most dependent thing in the world. Food is an essential thing for a person to live and carry out his daily activity. To achieve this there must be a positive yield from the side of farmers. Weeds being the main reason to decrease the yield, the proposed solution can make an impact in the agriculture field mainly concentrated by the small scale and marginal farmers. This system is user friendly, efficient, economical when compared to other conventional methods present outside. The proposed prototype consists of steel less body whereas the developed product will be based on steel. This system is also designed in order to monitor the functioning and the movement of the robot in an external app. As pi-cam is being used the live streaming will become an easier one and also in case of some mishaps that occur to the agri-bot, it can also be controlled with the same app used to monitor the robot.

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